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Assessing Federal Grade Criteria for Fruits and Vegetables: Should Nutrient Attributes Be Incorporated?

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Executive Summary

The existing federal grading system for fruits and vegetables is based on sensory factors such as skin color, injury, or size. However, increased "health consciousness" among consumers raises questions regarding the inclusion of nutrients in fruit and vegetable grade criteria.

A review of existing grades for fruits and vegetables reveals that nutrient attributes must meet three necessary conditions before they can be included in grade standards. These three conditions are (1) measurability, (2) a body of information which provides a reference point in setting the grade, and (3) variability among individual specimens of the commodity.

Despite advances in technology, cost effective and timely measurement of the nutrient attributes of fruits and vegetables is available for only some nutrients. Adequate information also is available for only some nutrients contained in fruits and vegetables. In contrast, a review of the scientific literature revealed that nutrient attributes vary among specimens of a given fruit and vegetable. Consequently, a shift from the current sensory standards to one based on nutrient attributes does not appear to be economically feasible at present for many nutrients, and for some nutrients measurement is not even physically possible.

Assessing grade criteria involves both economic feasibility and the role of government in providing consumer information. While economic feasibility appears limited, the role of government in "signaling" consumers needs to be considered. This public policy role recognizes that numerous real-world scenarios produce statistically indistinguishable outcomes with respect to the traditional concerns of economic policy: efficiency, equity, market power, and market failure. In its signaling roll, government aggregates concerns through the political process, then signals the private sector how the public sector would like the private sector to "act" or "allocate resources" within the set of feasible outcomes.

Current federal grades signal to the private sector that the consumer values sensory attributes of fruits and vegetables. Evidence suggests the private sector has allocated resources so as to assure consumers that these attributes are attained. Including nutrients in existing grades would signal the private sector to devote more resources to monitoring and improving the nutrient value of fruits and vegetables. Thus, a feasible policy option may be a pilot study of incorporating selected nutrients into grade standards. The nutrients selected should meet the necessary conditions discussed above.

Another consideration is whether sensory attributes convey information about nutrient attributes. To evaluate this consideration, the past 10 years of *International Food Science and Technology Abstracts* were examined for apples, oranges, potatoes, and tomatoes. Some relationships are found, but the overall conclusion is that much is unknown about the relationship between sensory and nutrient attributes. Thus, a policy option is to increase funding for studies which investigate the link between sensory and nutrient attributes.

Assessing Federal Grade Criteria for Fruits and Vegetables: Should Nutrient Attributes Be Incorporated?

The United States Department of Agriculture (USDA) has a long-established system for fruit and vegetable grades (USDA, Agriculture Marketing Service (AMS) January 1990). A primary purpose of federal commodity grades is to facilitate the wholesale exchange by allowing sale by description rather than by inspection (Office of Technology Assessment 1977). Consequently, buyers and sellers can consummate transactions without the time and expense necessary to physically congregate in one location to inspect the commodity being sold. The result is lower transaction costs, which in turn can mean lower prices for consumers and/or higher prices for producers.

Current grade standards for fruits and vegetables use attributes based on sensory characteristics, shelf-life considerations, palatability considerations, or a combination of these factors. Sensory characteristics affect consumers' senses, such as touch, sight, and taste.

During recent years "health consciousness" has increased among consumers. Furthermore, a growing number of studies have demonstrated health benefits from various nutrients contained in relatively large amounts in fruits and vegetables (e.g. *Consumer Reports* October 1992, 648). Consequently, the question arises regarding the feasibility and desirability of incorporating nutrient attributes into current standards or replacing the current sensory-based standards with nutrient-based standards. This question provides the impetus and focus for this research[1].

Initially, the focus is on the economic function and consequences of commodity grades. Then, the current federal grading system for fruits and vegetables is described. From this description, some generic components of the current federal grade standards are generated. The potential for adding nutrient attributes is discussed next, followed by a discussion of the relationship between sensory and nutrient attributes. The manuscript concludes by presenting an evaluation of the feasibility of a nutrient-based grading standard for fruits and vegetables.

The Economic Function and Consequences of Grades

Fruits and vegetables, like most farm commodities, exhibit a wide array of quality attributes. An important function of the grading system is the "grouping of continuous quality gradations of a commodity into a few grades or classes" (Rhodes 1988). If the resulting differentiation of the commodity communicates relevant information about quality attributes important to market participants, then the grading system will allow wholesalers, retailers, and others to exchange commodities on the basis of description rather than personal inspection. As a consequence, transaction costs are lowered, and overall marketing efficiency is enhanced (Farris 1960). In addition, federal grades also are thought to improve public price reporting (Henderson, et al. 1983).

Once a commodity is sorted into a few grades, each grade can command price based upon its quality attributes. Thus, producers receive price signals through the market about what to produce -- i.e., the quality attributes which maximize their returns. Also, grades can potentially affect the geographic distribution of production (Nichols, et al. 1983).

Critics of the current grading system often argue that it does not capture the quality attributes which are relevant to buyers, particularly consumers. However, attributes may be excluded because they are difficult to measure and/or transmit through marketing channels. Moreover, Rhodes and Kiehl (1956) observe that differences among consumers may be so great that it is difficult to establish homogenous grade categories which capture these differences. In short, a grading system must compromise between being easily understood by market participants and capturing the complexity and diversity of consumer demand. Furthermore, Padberg (1977) argues that a grading system can have value even it is not well understood and used by consumers in making purchasing decisions. The mere existence of grades can reassure consumers that a government agency is monitoring product quality.

Current Federal Grades for Fruits and Vegetables

Current grade standards for fruits and vegetables are administered by USDA under authority of *The Agricultural Marketing Act of 1946*. One hundred and fifty eight grade standards cover 85 fresh fruit, vegetable, nut and related commodities. One hundred and fifty five grade standards cover 74 processed fruits, vegetables and related commodities. The grade standards for fruits and vegetables can be grouped as follows[2]:

Fruits for Fresh Market:	
Wholesale Market	- 29
Raw Products for Processing	- 15
Fruits for Processing	- 15
Canned Fruits	- 36
Dried and Dehydrated Fruits	- 14
Frozen Fruits	- 21

Vegetables for Fresh Market:	
Wholesale Market	- 58
Consumer Retail Market	- 12
Vegetables for Processing	- 24
Canned Vegetables	- 39
Frozen Vegetables	- 26

The dates when the current grade standards became effective vary widely, but a majority for fresh fruit and vegetables pre-date 1960. Grade standards for processed fruit and vegetables generally are of more recent vintage.

Grading factors listed in standards for fresh and processed fruits and vegetables can be broadly divided into four main categories: size, quality, condition, and tolerances. Size can be described by diameter, length, weight, and uniformity of sizing (USDA, AMS, April 1988). Quality factors are defined as "the combination of the inherent properties or attributes of a product which determines its relative degree of excellence" (Harl 1990). In general, quality factors refer to attributes which remain permanent once the commodity is harvested or processed. Examples include variety, cleanliness, and shape for fresh fruits and vegetables; and color, clarity, and flavor and aroma for processed fruits and vegetables.

Condition refers to: "the relative degree of soundness of a product which may affect its merchantability and includes those factors which are subject to change and may result from but not necessarily limited to age, improper handling, storage or lack of refrigeration..." (*Code of Federal Regulation* January 1990). In contrast to quality factors, condition factors can change once the commodity is harvested or processed.

Tolerances are legal limits on unacceptable size, quality, and condition grading factors. They generally are stated in percentage terms, and can vary by product, use, or size of the individually packaged product. For example, the tolerances for U.S. Number 1 apples for processing illustrate the variety of forms that tolerances can take: (1) no more than 10 percent of apples with quality and condition defects including no more than 2 percent of apples with decay, 2 percent with internal breakdown and 5 percent with wormholes, and (2) the apples cannot be further advanced in maturity than generally firm ripe (*Code of Federal Regulation*, Part 7, Sections 51.300 to 51.349, January 1990).

Unlike fresh fruits and vegetables, tolerances for processed commodities usually are stated in terms of a grade score for the attribute. Scores are based on an assessment of the degree to which the attribute is present. The higher the score, the better the grade. A minimum score exists for each grade. Any commodity which fails to meet the minimum requirement of the lowest grade becomes part of the "substandard" grade. As examples of the scoring system, good color and clarity of U.S. Grade A frozen concentrated apple juice must have a score of 18 to 20, while U.S. Grade A canned orange juice must have a minimum total score of 90 (*Code of Federal Regulation*, Part 7, Sections 52.1551 to 52.1557 and 52.6321 to 52.6332, January 1990).

Size, quality, and condition grading factors have three elements in common. First, they are measurable or observable. Second, there is a common body of knowledge which allows a widespread acceptance of how the factor will be applied in determining the grade. Third, the factor varies among individual specimens of the commodity. The existence of tolerances reflect this variability by allowing a sample to obtain a given grade even though all specimens in the sample do not meet minimum quality, condition, and size.

Nutrient Attributes and Federal Grades

The idea that federal grade standards might be based on nutrient attributes is not new. The Office of Technology Assessment released a report in 1977 which addressed this issue across a broad array of food items.

Necessary conditions for nutrition to be included in grades are the three common elements shared by size, quality, and condition factors contained in the current grading standards: (1) measurability, (2) a body of information which provides a reference point in setting the grade, and (3) variability among individual specimens of the commodity. Each of these three necessary conditions is discussed below.

Assessment of Current Techniques and Methods for Measuring Nutrient Attributes

Besides water, fruits and vegetables usually contain significant amounts of most or all types of carbohydrates, such as sugars, starches, and fiber. They also contain vitamins (notably A and C) and smaller, but not nutritionally insignificant, amounts of minerals and protein[3]. Specific methods of analysis exist for each nutrient category. These methods have varying degrees of accuracy, simplicity, and cost.

Beecher and Vanderslice (1983) have placed methods of nutrient analysis into categories of adequate, substantial, conflicting and lacking (Table 1). They argue that "the boundary between acceptable and unacceptable methods lies between substantial and conflicting states of methodology" (Beecher and Vanderslice 1983, 42). Adequate and substantial methodologies have an "analytical value within 10 percent of a true value when a nutrient is present in food at a nutritionally significant level, defined as greater than 5 percent of the RDA per standard serving or daily intake, whichever is greater" (Beecher and Vanderslice 1983, 42). Conflicting and lacking states of methodologies are "doubtful" to render valid results under conditions of routine analysis.

A general cost figure for nutritional analysis of fruits and vegetables is in the area of $10-15 per simple item, such as sugars, minerals, and vitamins. These are costs from publicly available laboratories in the Ohio university and extension services. Such costs might be higher at private for-profit labs. Additionally, items difficult to assay or which exist in minute quantities in fruit and vegetable samples might require more elaborate testing and therefore be more expensive. For example, a complete amino acid analysis for protein costs about $300.

Technological advances are improving the ability to accurately and expeditiously measure nutrients. An example is flow injection chromatography (Stewart). It permits numerous rapid sequential analyses and is appropriate for constituents other than proteins, including vitamins and carbohydrates. Advances in computer technology also point toward further miniaturization of techniques as well as improved speed and accuracy.

State of Knowledge Regarding Nutrient Value of Fruits and Vegetables

Beecher and Vanderslice's (1983) survey suggests that, while much is known about the nutrient value of fruits and vegetables, inadequate, little, or no data exist for 9 nutritional components of fresh fruits, 14 nutritional components of frozen or canned fruits, 18 nutritional components of fresh vegetables, and 12 nutritional components of frozen and canned vegetables (Table 2). The lack of adequate information is due in part to the minute quantities of some nutritional components in fruits and vegetables. In addition, data are sometimes lacking regarding the exact nature of these components' contribution to human nutrition. For example, the fat soluble vitamins (A, D, E and K) can be accurately assayed and quantified in most samples. However, quantities of these vitamins may be present in bound form or other forms not utilizable or under-utilized in human physiological processes. While acknowledging these considerations, additional research on the nutrition of fruits and vegetables is needed before all nutrient attributes can be included in a grading standard.

Variation in Nutrient Attributes

To examine whether the nutrient attributes vary among individual specimens of a fruit or vegetable, a case study was made of the known information for apples, oranges, potatoes, and tomatoes. These commodities were selected because they represent a wide variety of grade standards and have relatively high per capita consumption in today's food markets. Annual per capita consumption of these four commodities ranges from about 15 pounds for oranges to over 127 pounds for potatoes (USDA September 1993).

The case study was conducted by examining volumes from the past 10 years of the *International Food Science and Technology Abstracts*. This reference is a comprehensive source of international research. It abstracts hundreds of academic journals, books, technical and trade publications from all subject areas related to plants, food, and human nutrition, including such diverse areas as cellular biochemistry, nutrition, plant genetics and public policy. The period evaluated covers the state-of-knowledge from the most recent literature.

The review found that the nutritive composition of apples, oranges, potatoes, and tomatoes varies due to factors of climate, geographic location, cultivar, soil variables, irrigation practices, fertilization practices, seasonal and annual variation. Furthermore, the complicated area of post-harvest physiology and handling introduces additional sources of variation in nutritional composition[4].

Interrelationship of Nutrient and Sensory Attributes

A related consideration is whether sensory attributes also convey information about nutrient attributes. To examine this consideration, a matrix relating current sensory grade criteria to nutrient attributes is evaluated. Columns in this matrix are various nutrient attributes. Rows are the current grade criteria generalized across all fruits and vegetables. As previously discussed, these criteria are quality, condition, and size. Quality criteria commonly involve maturity, cleanness, shape and form, color, and quality defects. Condition criteria commonly involve firmness, condition defects, and ground color.

Not all cells of the matrix are expected to be of equal relevance. Furthermore, if a nutrient standard is adopted, one would not expect all the nutrient criteria listed as columns to be included in the standard.

There are no compelling reasons to exclude cells formed by the matrix from examination, except for the cells involving cleanness and shape/form. These two current sensory grade criteria are not related to nutrition attributes, and, therefore, are shaded to indicate that no correlation is expected.

Each of the remaining 117 cells, in effect, defines a specific topic where knowledge from scientific journals could exist. The existing scientific literature for each of the relevant cells was carefully reviewed for applies, oranges, potatoes, and tomatoes. As in the previous section, the past 10 years of volumes of the *International Food Science and Technology Abstracts* were examined for research literature relevant to the matrix.

Results of this review are summarized in Table 3. A letter for each of the investigated commodities (A for apples, O for oranges, P for potatoes, and T for tomatoes) is placed in a cell if information existed about the nutrient-sensory interaction. Only eight percent of the 468 total cells (117 for each commodity) indicate that at least one research article exists. The inevitable conclusion is that much is unknown about the interrelationship between sensory and nutrition-related attributes. This conclusion is expected because the linkage between nutrient content and quality and morphological considerations is a novel research area.

Nevertheless, some relationships do appear. The relationships between maturity and nutrition, especially vitamin C and carbohydrates, are the most researched. The more mature potatoes and tomatoes are, the greater the concentration of vitamin C. In contrast, vitamin C decreases dramatically in oranges and potatoes the longer these commodities are held in storage. Carbohydrates in apples and tomatoes are positively related to maturity. In potatoes, starch is more readily converted to sugars after harvest. Conversely, oranges show a decrease in glucose and fructose during storage as well as when in a decaying state[5].

Many of the reviewed articles address post-harvest changes. These changes are not related to maturity, but do illustrate the importance of post-harvest storage and handling techniques to the nutritional value consumers ultimately derive from a stored fruit or vegetable.

This analysis has not extrapolated research from one cell to another even though such extrapolation is often reasonable. For example, research shows that maturity generally positively correlates with vitamin content. Because firmness and color (e.g. in tomatoes, a deeper red color) increase with maturity, the considerable research findings concerning maturity probably can be extrapolated to firmness and color.

Evaluation and Conclusions

This manuscript has evaluated the potential for shifting from the current sensory based federal grading standard for fruits and vegetables to one based on nutrient attributes. The evaluation of this policy change focused on three necessary conditions which an attribute must meet in order to be included in a grade standard: (1) measurability, (2) a body of information which provides a reference point in setting the grade, and (3) variability among individual specimens of the commodity.

Despite advances in technology, cost effective and timely measurement of the nutrient attributes of fruits and vegetables is available for only some nutrients. Furthermore, adequate information is available for only some nutrients of fruits and vegetables. In contrast, a review of the scientific literature revealed that nutrient attributes vary among specimens of a given fruit and vegetable. Therefore, only the third necessary condition is unequivocally met. Consequently, a shift from the current sensory standards to one based on nutrient attributes does not appear to be economically feasible at present for many nutrients, and for some nutrients measurement is not even physically possible.

While economic feasibility appears limited, "signaling" as another facet for the role of public policy needs to be considered. This public policy role recognizes that numerous real-world scenarios produce statistically indistinguishable outcomes with respect to the traditional concerns of economic policy: efficiency, equity, market power, and market failure. In its signaling role, government aggregates concerns through the political process, then signals the private sector how the public would like the private sector to "act" or "allocate resources" within the set of feasible outcomes. Should the private sector respond satisfactory, the public sector will not enact regulations or codes of conduct on the private sector.

Current federal grades perform a signaling function by indicating to the private sector that consumers value sensory attributes of fruits and vegetables. Economic arguments, as well as empirical and antidotal evidence suggest sensory-based grades have caused private resources to be allocated so as to assure consumers that these attributes are attained.

For signaling reasons, it could be argued that nutrients should be included in grading standards for fruits and vegetables. Including nutrients would signal the private sector to devote more resources to monitoring and improving the nutritional value of fruits and vegetables in particular, as well as the nutritional value of food in general. Furthermore, by creating grades based on nutrient level, the grading system will allow consumers to express their desires through premiums and discounts for different nutrient levels. Based on existing scientific information, the following externalities may be generated by including nutrients into current grades: improved quality of life and lower medical expenses. These externalities may be large enough to justify the transition costs involved in including nutrient attributes in fruit and vegetable grades, especially in a policy environment where public health care is a top priority[6].

Thus, a feasible policy option may be a pilot study of incorporating selected nutrients into grade standards for selected fruits and vegetables. These pilot studies would involve nutrients that meet the necessary conditions discussed above.

Another feasible policy option is to increase funding for studies which investigate the link between current sensory attributes and nutrient attributes. This emerging area of investigation appears to hold some promise for establishing a link between sensory and nutrient attributes. If sufficient links are found, the current sensory standards might be used to provide nutrient information.

ENDNOTES

1. Given consumer concerns about pesticides in food, a similar question has been raised about incorporating chemicals in current grade standards. This question is discussed in Appendix A.

2. A complete listing of the fruit and vegetable grades are contained in the Office of Technology Assessment Report, "Assessing Federal Grade Criteria for Fruits and Vegetables." 1992.

3. A few commodities, such as avocados and olives, have fat as a major component. In addition, fats are very important in tree nuts, which are often listed among fruit commodities.

4. A complete annotated listing of the literature reviewed is presented in the Office of Technology Assessment Report, "Assessing Federal Grade Criteria for Fruits and Vegetables." 1992.

5. A complete annotated listing of the literature reviewed is presented in the Office of Technology Assessment Report, "Assessing Federal Grade Criteria for Fruits and Vegetables." 1992.

6. Health professionals often point out that the only relevant link is between diet and health, not between consumption of one food and health. Diet includes all foods consumed, and is important because of significant known interactions among foods. This observations tempers the value of nutrient information about an individual food, but does not negate the signalling value of potentially including nutrients in grading standards for fruit and vegetables.

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Table 1. State of Development of Methods for Analysis of Nutrients in Foods

Nutrient Category	State of Methodology[a/]			
	Adequate	Substantial	Conflicting	Lacking
Carbohydrates, fiber and sugars Energy		Individual sugars	Fiber Starch Food energy	
Lipids		Cholesterol Fat (total) Fatty acids (common)	Sterols Fatty acids (isomeric)	
Minerals/inorganic nutrients	Calcium Copper Phosphorous Potassium Sodium Zinc Magnesium	Iron (total) Selenium	Arsenic Chromium Fluorine Manganese Iodine	Cobalt Heme-iron Molybdenum Nonheme iron Silicon Tin Vanadium
Proteins and amino acids	Nitrogen (total)	Amino Acids (most)	Amino Acids (some) Protein (total)	
Vitamins		Niacin Riboflavin Thiamin Vitamin B6	Vitamin A Carotenes Vitamin B12 Vitamin C Vitamin D Vitamin E Folacin Pantothenic acid	

a/ **Adequate** and **substantial** methodologies will have analytical values that are within 10% of true values for foods when the nutrient of interest is present at nutritionally significant levels (greater than 5% of the RDA per standard serving or daily intake, whichever is greater). **Conflicting** and **lacking** methodologies can occur for some nutrient categories for the following reasons: a.) methods lack specificity because some nutrient components have closely related molecular structures, or b.) some methods lack sensitivity.

Table from: Beecher and Vanderslice 1983, 43.

Table 2. Knowledge of Nutrient Composition of Fresh Fruits, Frozen and Canned Fruit, Fresh Vegetables, and Frozen and Canned Vegetables

Nutritional Component	Fresh Fruits	Frozen and Canned Fruit	Fresh Vegetables	Frozen and Canned Vegetables
Individual Sugars	S	I	I	I
Starch	I	I	S	I
Nutrient Fiber	I	I	I	I
Total Fat	S	S	I	S
Fatty Acids	I	I	I	I
Sterols	I	I	I	I
Calcium	S	S	I	S
Iron	S	S	I	S
Phosphorous	S	S	I	S
Sodium	S	S	I	S
Magnesium	S	S	I	S
Potassium	S	S	I	S
Zinc	S	I	I	S
Total Protein	S	S	S	S
Individual Amino Acids	I	I	S	I
Folacin	I	I	I	I
Vitamin D	NA	NA	NA	NA
Vitamin E	S	I	I	I
Biotin	I	I	I	I
Choline	I	I	I	I
Pantothenic Acid	I	I	I	I
Vitamin A	S	I	S	S
Vitamin B1 (Thiamin)	S	S	S	S
Vitamin B2 (Riboflavin)	S	S	S	S
Vitamin B6	S	I	I	I
Vitamin B12	NA	NA	NA	NA
Vitamin C	S	S	S	S
Niacin	S	S	S	S

KEY CODE: S - substantial data, I - inadequate, little, or no data, and NA - not applicable.

Table from: Beecher and Vanderslice 1983, 34-41. Table prepared from USDA, Nutrient Data Research Branch, Consumer Nutrition Division of the Human Nutrition Information Service research publications.

Table 3. Summary Table of Scientific Literature on the Relationship Between Sensory and Nutrient Attributes for Apples, Oranges, Potatoes, and Tomatoes

Current Grade Criteria, Generalized Across All Fruits & Vegetables[a]	Nutrient Attributes								
	Vitamins	Minerals	Calories	Enzymes & Proteins	Carbo-hydrates	Oils & Fats	Sodium	Calcium	Fiber
Quality									
Maturity	A, O, P, T	A, O, P, T	T	O	A, O, P, T	O, T		A, O, T	A, T
Cleanness									
Shape/Form									
Color									
Quality Defects									
Fungus Injury									
Insect Injury									
Mechanical Injury					P				
Other[b]									
Condition									
Firmness									A, T
Condition Defects									
Decay	O				O			A	
Bruising	P								
Freezing	P, T				P	T			
Discoloration									
Ground Color/Color									
Size					P				

KEY CODE: A = apples, O = oranges, P = potatoes, T = tomatoes

a/ This list contains the criteria which *predominate* across all fruits and vegetables. Other criteria are specific to an individual fruit or vegetable. Their omission has little consequence for the present assessment.

b/ Other is defined as ill-shaped, undesirable color, sunburn, growth cracks, and/or dirt.

APPENDIX A: Chemical Residues and Federal Grades

Incorporation of chemical attributes into grades has been raised as a response to consumer concerns about pesticide "contamination" of food. Objective facts do not lend much support for the current degree of concern. For example, in 1989, the state of California sampled 9,403 food samples for pesticide residues (Parnell 1990). The following distribution was found:

No detectable residues	77.9% of the samples
Residues less than 10% of tolerance level	13.0% of the samples
Residues between 10% and 50% of tolerance	7.4% of the samples
Residues from 50% to 100% of tolerance	1.0% of the samples
Exceeded tolerance level	0.7% of the samples

Objective of implementing a chemical residue standard would be to allow consumer choice among various levels of "safe for human consumption residue" at alternative prices. However, including chemical residues in a grading system mixes aspects of food safety with aspects of food quality. This "mixing" markedly differs from the existing grading system, which essentially assigns grades only to food determined to be safe for human consumption (Sporleder et al. 1983). Thus, the chances for consumer misinformation from incorporating chemical residues into a grading system probably is high. Because of this problem, a chemical residue base for grading standards is unlikely to be viable.

In addition, continued presence of a given pesticide residue on food is likely to be associated with other environmental problems, such as residue problems in the farm production environment. Hence, a more appropriate policy response probably is to restrict the use or pull the registration of a pesticide which continually leaves residues on food.